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Users Acceptance of Health Behavioral Change Support Systems

Emergent Research Forum Papers

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Abstract

Behavioral Change Support Systems (BCSSs) is a socio-technical information systems with psychological and behavioral outcomes aim to change users' behavior and lifestyle. The promising outcomes of BCSSs make them especially useful in certain areas such as healthcare, where these systems could be leveraged to motivate people toward healthy behavior and then help them to achieve their goals better. However, health BCSSs cannot help facilitate self-monitoring and self-management or even improve patients' health outcomes when patients do not accept the technology first. In this article, we extend the existing literature of users' acceptance of health BCSSs by introducing new variables that impact users acceptance, especially with the proliferation of wearable devices. Specifically, we intent to examine the impact of integration, technical and social support as well as the informative presentation support on users' acceptance of mobile diabetes applications as instance of health BCSSs.

Keywords

Health, Behavioral Change Support Systems (BCSSs), Mobile Apps, Acceptance.

Introduction

A Behavioral Change Support System (BCSS) is “a socio-technical information system with psychological and behavioral outcomes designed to form, alter or reinforce attitudes, behaviors or an act of complying without using coercion or deception” (Oinas-Kukkonen 2013). This definition includes three potential successful voluntary outcomes for a BCSS: the formation, alteration or reinforcement of attitudes, behaviors, or complying (Oinas-Kukkonen 2013). These promising outcomes make BCSSs especially useful in certain areas such as healthcare, where these systems could be leveraged to motivate people toward healthy behavior and then help them to achieve their goals better (Oinas-Kukkonen 2013; Oinas-Kukkonen and Harjumaa 2008). Behavioral change support systems (BCSSs) have demonstrated great potential in contemporary health-related prevention services, applications and products (Chatterjee and Price 2009). Due to its role in fostering improved health and healthier lifestyles, health BCSS is considered nowadays one of the most prominent areas for future healthcare improvements (Oinas-Kukkonen 2013). Indeed, health BCSSs have been reported to produce positive results in areas such as management of smoking cessation, hazardous drinking, obesity, diabetes, asthma, tinnitus, stress, anxiety and depression, complicated grief, and insomnia (Strecher 2007). These technologies can be delivered via the Web, SMS, health social networking systems, or by other state-of-the-art technological means such as health interventions available via mobile devices (Oinas-Kukkonen 2013).

A recent meta-analysis study conducted by Or and Tao (2014) showed that the use of consumer health BCSSs in supporting diabetes self-care appears to have potential benefits for patients' self-management of diabetes. These technologies have the potential to release patients from high hospital care costs, improve healthcare convenience, promote communication between clinician and patients, and empower patients to gain more control of their disease care (Or and Tao 2014). In fact, advances in smartphone technology and wireless networks have resulted in increased adoption and enhanced capability, leading to

opportunities for improved diabetes self-management (El-Gayar et al. 2013). Health-related mobile applications (usually referred to as apps) that run over smartphones hold promise for healthy behavior change (Yoganathan and Kajanan 2014) and help reduce the risk of long-term disability. However, healthcare apps as health behavior change support technology have not been used to their fullest strength. Only 26% of healthcare apps are downloaded with only one use and 74% of them drop out by the tenth use (McLean 2011). As a result, more research need to be performed to explore the efficacy of healthcare apps as patients adherence tools (McLean 2011). Particularly, it is important to examine the drivers for acceptance of these IT technologies to support one's diabetes self-management. By understanding a priori what factors are important in predicting patients' willingness to use health mobile technology, system developers can focus their efforts on those factors when designing the system or developing strategies to promote acceptance and adoption of health BCSSs. Such factors can (1) help create acceptance for the technology, (2) aid in developing and evaluating the ability of health BCSS applications to fulfill patients' needs and expectations, and (3) increase the likelihood of technology implementation success by enhancing patients decision making and persuading them toward better health behaviors that promote health and well-being. In this regard, a systematic review of research regarding patient acceptance of Consumer Health Information Technology (CHIT) revealed that there may be other important organizational, environmental, and social variables to examine (Or and Karsh 2009). In order for BCSSs to be successfully implemented, the needs of patients end-users (physical, psychological, and social) must be adequately met and addressed (Or and Karsh 2009). Therefore, this study aims to explore the impact of variables previously derived from the actual use of the mobile diabetes self-care applications on the acceptance of these systems as an instance of health BCSSs. These variables are (1) the technical support as *organizational support factor*, (2) integration support as an important *environmental factor*, (3) *social support* and (4) informative presentation as important *primary-task support factor*.

From a theoretical perspective, this research is expected to contribute to the nascent literature pertaining to users' acceptance of health BCSSs in three aspects. First, we introduce "*integration support*" construct which is very timely in the era of wearable devices. Second, we introduce "*informative presentation*" as an important primary task in BCSSs. Last but not least, to our knowledge, we are the first to explore the influence of the *technical* and *social support* on user acceptance of BCSSs. From practitioners' perspective, the research is expected to further contribute to the fledging health development industry, particularly with the proliferation of wearable technologies.

Theoretical Background and Research Model

In this research, we have decided to build our research model mainly based on the design principles discovered from the actual use of diabetes mobile applications (Al-Ramahi et al. 2016). In their study, Al-Ramahi et al. (2016) identified design principles of health BCSSs from user feedback (i.e. online user reviews).

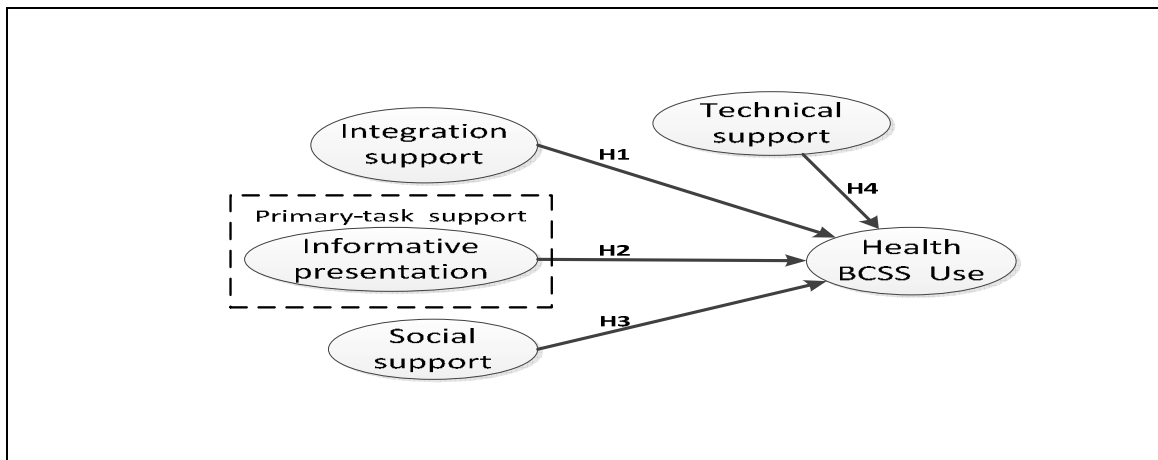


Figure 1: Conceptual model

These principles are structural, which is mapped to integration support construct in our model, informative presentation as primary-task support and lastly social support. The fourth construct in our

model, which is related to organizational support is the technical support (Or and Karsh 2009). The proffered research model is depicted in Figure 1 above.

Integration support

Environmental factors refer to the physical aspects of the environment, for example when Consumer Health Information Technologies (CHITs) are designed to be used at home, the environment can be the residential living space where the patients interacts with the technology (Or and Karsh 2009). Environmental factors are crucial because they will impede or facilitate individuals' abilities to use technology effectively and efficiently, which in turn can influence technology acceptance of the individual (Or and Karsh 2009). Indeed, few studies in literature examined the impact of environmental factors on acceptance of health BCSSs. In this regard, only one variable was examined, which is the patient location when using the technology. Additional environmental factors that refer to the physical aspects of the environment where the patient interacts with the technology should be also taken into account (Or and Karsh 2009). This is especially important nowadays with the proliferation of wearable devices. In this regard, the integration support refers to the integration with the supporting elements in users' environment (Al-Ramahi et al. 2016). The mobile diabetes applications as health behavioral change support technologies should help users to integrate with the supporting elements in their health environment such as *glucose meter, insulin pump, clouds, other mobile devices and doctors* (Al-Ramahi et al. 2016). Based on the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003), the facilitating conditions, *the degree to which an individual believes that a technical infrastructure exists to support use of the system*, are significant to motivate individuals to use the information technology. Therefore, we hypothesize that the health BCSSs that support integration with physical elements in user's environment are more likely to be accepted by users.

Hypothesis 1: *Integration support in health BCSSs will positively influence users' acceptance of these technologies.*

Informative presentation

Al-Ramahi et al. (2016) identified four technological design principles for health persuasive systems from the actual use of these technologies. Here we focus on the informative presentation design principle. It refers to providing users with readable and informative graphs, reports, and charts of their health-related data depicting their improvement patterns and historical trends. *Informative presentation* could be mapped to the *performance expectancy* in the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003). Performance expectancy is defined as the degree to which an individual believes that using the system will help him or her to attain gains in job performance (Venkatesh et al. 2003). In the health care context, depicting users' health-related data in an informative and easy-to read graphs and charts that show them improvements patterns and provide a clear picture of their historical trends is expected to improve users' perception that using the system will help them achieve their health goals better. This in turn will positively affect their acceptance of the system. Therefore, we predict that the informative presentation in health BCSSs will positively influence the acceptance and use of these technologies.

Hypothesis 2: *Informative presentation in health BCSSs will positively influence users' acceptance of these consumer health technologies.*

Social support

According to Al-Ramahi et al. (2016), social support refers to the functions that help users to connect with their peers to share experience and support. This can be achieved by providing a social forum that helps all system users meet together to exchange informational and emotional support. Such functionalities are expected to increase users' perceived social support, which in turn increase one's perceived usefulness of the system. In fact and due to its positive impact on individuals' health behavior and attitude (McCarroll et al. 2014), social support becomes one of the primary desires that users in healthcare systems seek to obtain through peer-to-peer interactions (Al-Ramahi and Park 2015). Therefore, we anticipate that the existence of appropriate social support functionalities in health BCSSs will positively influence users' perceived social support which in turn will increase users' acceptance and use of these technologies.

Hypothesis 3: *The existence of social support functions in health BCSSs will positively influence users' acceptance of these technologies.*

Technical support

According to the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003), the degree to which an individual believes that an organizational support exists to support the use of the system is significant to motivate individuals to use the technology. Higher levels of organizational support, which in the case of patients could be support from their clinic or hospital, are believed to promote more favorable beliefs about the technology, which could then improve acceptance (Igarria et al. 1995). However, other important organizational factors such as *technical support*, which refers to technical help provided by the system developers upon request, need to be examined. Technical support has received empirical support in literatures outside of consumer health informatics and there are reasons to hypothesize that it would be also important here (Or and Karsh 2009). In fact, technical support has been found an important factor in technology acceptance of Telehealth systems by elderly patients (Cimperman et al. 2013; Singh et al. 2010). It makes sense as well to suppose that it would be important factor for health BCSSs acceptance. Therefore, we hypothesize that the existence of adequate technical support in health BCSSs will positively influence the acceptance of these technologies.

Hypothesis 4: *The existence of adequate technical support in health BCSSs will positively influence users' acceptance of these technologies.*

Proposed research methodology

Method

We will conduct a survey method to assess our hypotheses. It is required that each participant of our survey is a user of diabetes self-management app and will be asked about his/her experience using these health informatics technologies. Specific data regarding the subjects' health position and demographics will also be collected. Table 1 includes the constructs definition and the number of items that are planned to be used in the study.

Construct	Definition	#of Items
Integration support	Integrates users' health data with other supporting elements in their health environment such as insulin pump, clouds, and doctors (Al-Ramahi et al. 2016).	3
Informative presentation	Provides users with readable and informative graphs, reports, and charts of their health-related data depicting their improvement patterns and historical trends (Al-Ramahi et al. 2016).	8
Social support	Provides users with a social forum to help them connect with their peers to share experience, emotional support and motivation to achieve their goals better (Al-Ramahi et al. 2016).	3
Technical support	Provides users with adequate technical support when they have problems using the system (Singh et al. 2010).	3
Health BCSS Use	The intention to use the system (Venkatesh et al. 2003).	3

Table 1. Construct definitions and the number of items

Data Analysis

Partial least squares (PLS), as implemented in PLS-Graph version 3.0, will be used for data analysis. The PLS approach allows researchers to assess measurement model parameters and structural path coefficients simultaneously (Barclay et al. 1995). PLS will be used for several reasons: (1) this study was primarily intended for causal-predictive analysis; (2) PLS requires fewer assumptions about data

distributions than the covariance-based strategy of LISREL (e.g., assumptions of normality); and (3) PLS is effective for those early-theory testing situations that characterized this study. Therefore, PLS is an appropriate statistical analysis tool for the current study. It focuses on a prediction-oriented and data-analytic method, seeking to maximize the variances that are explained in the constructs (Barclay et al. 1995).

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